

SYNONYMY AND DISTRIBUTION OF
PHYLLOMEDUSA BOLIVIANA BOULENGER
(ANURA: HYLIDAE)

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Abstract.—The correct name for the large, black-eyed species of *Phyllomedusa* from Bolivia, adjacent Brazil and northern Argentina is *Phyllomedusa boliviana*; *P. pailona* Shreve is a junior subjective synonym. The tadpole is a generalized phyllomedusine type. With the exception of the syntypes, none of the specimens referred to *P. boliviana* in the literature has been identified correctly.

Boulenger (1902) described *Phyllomedusa boliviana* on the basis of a male and female from Chulumani, on the eastern slopes of the Andes in Bolivia. Until the revision by Funkhouser (1957), no additional specimens were referred to that species. Funkhouser did not examine the type specimens, and her relegation of several specimens from Buena Vista, Bolivia, to this species was based solely on the description of the species.

In the course of studies on the systematics of phyllomedusine frogs, I have examined all of Funkhouser's material and one of the syntypes of *P. boliviana*. None of the specimens examined by her can be ascribed to that species. Rather, they represent an undescribed species apparently related to *P. tarsiatus*, *P. trinitatis*, and *P. venusta*, and will be treated in a paper dealing with the systematics of these species.

In addition, I have collected *P. boliviana* at the type-locality and also in northern Argentina, where the species is known as *Phyllomedusa pailona*, described from El Pailón, Bolivia, by Shreve (1959). Live specimens from Chulumani and Argentina are similar in the possession of a blackish-brown iris and eyelid edged in red. Direct comparison of the holotype and paratypes of *P. pailona* with the syntype of *boliviana* leads me to conclude that only one species is represented, and that *Phyllomedusa boliviana* is the proper name for the species.

Materials and Methods

Measurements were taken as described by Duellman (1970). The following abbreviations are used: snout-vent length, SVL; standard length (distance from tip of snout to tip of coccyx) SL; tibia length, TIB; foot length, FOOT; head length, HLEN; head width, HWID; interorbital distance, IOD; internarial distance, IND; length of eyelid, ELID; length of eye, EYE; horizontal diameter of tympanum, TYMP; distance from anterior corner of eye to nostril, ENOS. Color notes from life are taken from the field notes of the author. The following museum acronyms were employed: American Museum of Natural History, AMNH; British Museum (Natural History), BMNH; Carnegie Museum, CM; Instituto Miguel Lillo (Tucumán, Argentina), IML; University of Kansas Museum of Natural History, KU; Museo Argentino de Ciencias Naturales, (Buenos Aires, Argentina), MACN; Museum of Comparative Zoology, MCZ; University of Michigan Mu-

seum of Zoology, UMMZ; United States National Museum of Natural History, USNM.

Phyllomedusa boliviana Boulenger

Fig. 1

Phyllomedusa boliviana Boulenger, 1902:395. Syntypes, BMNH 1901.8.2.49–50 (RR 1947.2.22.32–33) from Chulumani, Bolivia, 2000 m, P. O. Simons, collector.

Phyllomedusa (Pithecopus) boliviana.—Lutz, 1950:602, 621.

Phyllomedusa pailona Shreve, 1959:1. Holotype, MCZ 29677, El Pailón, 5 km from the eastern shore of the Río Grande, Depto. Santa Cruz, Bolivia, 350 m, Carl Gans and F. S. Pereira, collectors.—Duellman, 1968:6.—Duellman, 1977:163.

Pithecopus pailonus.—Lutz, 1966:236.—Laurent, 1967:232.

Diagnosis.—A large species of *Phyllomedusa* having 1) the first toe longer than, and opposable to, the second; 2) distinct, well-developed parotoid glands; 3) prevomerine teeth present in adults; 4) no calcar or dermal appendages; 5) a lightly reticulated palpebral membrane; 6) iris black-brown in life; 7) in life, upper eyelid edged with red, tubercles on flank white, tipped with red; concealed surfaces of hindlimb pale yellow-green with no markings.

Redescription of male syntype.—Head wider than body; snout short, rounded in dorsal view; in lateral view, truncate and inclined posteriorly from lip to nostril; canthus rostralis rounded, distinct; loreal region barely concave; lips thin and not flared; nostrils not protuberant, directed laterally; internarial region flat; eyes not protuberant; pupil vertically elliptical; palpebrum finely reticulated; parotoid gland well-developed, extending from eyelid to a point level with the insertion of the arm; supratympanic fold moderately developed, barely obscuring upper edge of tympanum; tympanum distinct, oval; anterior edge of tympanum separated from posterior corner of eye by distance of 1 mm. Axillary membrane absent; upper arm slender, forearm robust; ulnar fold low; relative lengths of fingers 1-2-4-3 from shortest to longest; finger discs about three-fifths diameter of tympanum; subarticular tubercles large, round to conical; supernumerary tubercles lacking on fingers; palmar tubercle barely distinct; prepollex enlarged, elliptical, bearing thin, horny nuptial excrescence; fingers lacking webbing.

Leg of moderate length, slender; no calcar or dermal ornamentation; inner tarsal fold absent; outer tarsal fold barely distinct; relative lengths of toes 2-1-3-5-4 from shortest to longest; toe discs rounded, shorter than those on fingers; inner metatarsal tubercle elliptical, low, flattened; outer metatarsal tubercle absent; no webbing between toes; subarticular tubercles large, round to conical; no supernumerary tubercles on toes.

Anal opening directed posteriorly at midlevel of thighs; anal opening a short tube, no flap; supra-anal fold present; pair of large tubercles present inferior and lateral to anus; skin of dorsal surfaces smooth, no tubercles; skin of chin and pectoral region finely areolate; skin of belly and ventral surface of thigh tubercular; skin of remaining ventral surfaces of limbs smooth, except for that of forearm and tarsus, which bears a few discrete tubercles; anterior flank tuberculate, posterior flank smooth; tongue lanceolate, barely notched posteriorly; free



Fig. 1. *Phyllomedusa boliviana*, male, KU 182969, SVL 64.8 mm.

for about one-half its length; prevomerine teeth present; dentigerous processes of prevomer small, separated medially by distance equal to width of one process, processes directed posteromedially at midlevel of elliptical choana; vocal slit short, extending from posterolateral corner of tongue to corner of mouth; vocal sac single, median, subgular.

In preservative, dorsal surfaces pale blue; dorsal surfaces of finger and toe discs gray; ventral surface of chin pale brown, with few diffuse cream spots; ventral surface of belly and thigh cream; ventral aspects of forearm and tarsus pale brown, with discrete white tubercles; ventral surfaces of hand and foot pale brown; ventral surfaces of shank and inner aspect of tarsus pale gray with pale brown mottling; anterior and posterior aspect of thigh pale blue-violet; few, indistinct white tubercles present on posterior aspect of thigh; anal region pale brown; paired anal tubercles and supra-anal fold white; white stripe present along heel, tarsus, and lateral border of fifth toe; border of upper eyelid, lower lip, and anterior flank white; most tubercles of anterior flank capped with small spot of dark gray pigment; white stripe at point of insertion of arm, demarcating the blue color of upper arm from cream region of chest; this stripe and lip stripe bordered inferiorly by thin gray line.

The male syntype is in excellent condition, except that the outer two toes of each foot are slightly desiccated. Also, there is a 1 cm incision in the midventral region. The female specimen is similar to the male syntype in most respects; Duellman (pers. comm.), however, noted that the palpebrum of the female was not reticulated.

Measurements of the syntypes (male/female) in mm.—SVL 54.3/75.2, TIB 23.9/



Fig. 2. Distribution of *P. boliviana*. Key to localities: 1. Caranavi; 2. Chulumani; 3. El Pailón; 4. Jaciara; 5. Aguas Blancas, Rio Pescado, and Finca Jakulica; 6. Yuto.

31.1, FOOT 18.0/23.7, HLEN 18.8/22.0, HWID 18.6/23.8, IOD 5.2/8.1, IND 4.1/5.1, ELID 4.2/5.7, EYE 6.1/8.3, TYMP 3.2/4.2, ENOS 5.0/5.2.

Coloration in life.—Dorsal surfaces, face, and tympanum lime green; upper eyelid edged with red; venter gray, with pale yellow splotches; lower lip, supra-anal fold, and tarsal fold white, edged with pale red; tubercles on flank white, tipped with red; tarsal fold white; ventral surfaces of hand and foot flesh-colored; axilla and concealed region of elbow pale yellow; groin, concealed surface of shank, tarsus, and thigh pale yellow-green with a hint of orange; anal region dark gray; paired anal tubercles pale yellow; finger and toe discs off-white; iris dark brown, almost black (D. Cannatella field notes, 12 December 1978).

The above notes are based on a sample of Argentinian specimens (KU 182969–90). Specimens from Chulumani, Bolivia (KU 183436–38) differed in the following points: the tubercles on the ventral surface of the forearm and tarsus, and the supra-anal fold were red-orange; the ulnar and tarsal stripes were white with a red-orange wash.

Distribution.—This species is known from the Andean slopes and eastern lowlands of Bolivia, and the lowlands of western Brazil and northern Argentina, at elevations of 350–2000 m (Fig. 2). Duellman (1977) followed Funkhouser (1957) in including Peru within the species' range, on the basis of her misidentified specimens. Likewise, the specimens from Restauração, Brazil, on which Heyer (1977) remarked, were compared to misidentified "*boliviana*"; the frogs from Restauração are not *boliviana*, but are referable to the undescribed species from Buena Vista mentioned above.

Variation.—The syntypes of *P. boliviana* and the type-series of *P. pailona*

Table 1.—Measurements (mm) of *P. boliviana* from northern Argentina; mean \pm 2 standard errors; range in parentheses.

Measurement	Males (n = 19)	Females (n = 3)
SVL	67.7 \pm 1.18 (63.6–74.2)	76.8 \pm 3.54 (74.8–80.3)
SL	65.3 \pm 1.18 (60.5–70.8)	72.3 \pm 3.10 (69.9–75.2)
TIB	28.4 \pm 0.47 (27.1–30.9)	31.4 \pm 0.59 (30.8–31.8)
FOOT	23.1 \pm 0.49 (20.8–24.6)	25.7 \pm 1.36 (24.4–26.7)
HLEN	23.2 \pm 0.28 (22.0–24.6)	24.6 \pm 1.40 (23.9–26.0)
HWID	23.0 \pm 0.28 (22.2–24.3)	24.6 \pm 0.54 (24.2–25.1)
IND	5.4 \pm 0.12 (4.9–6.0)	5.9 \pm 0.43 (5.5–6.2)
ENOS	5.4 \pm 0.06 (5.2–5.6)	6.0 \pm 0.30 (5.7–6.2)
TYMP	4.1 \pm 0.13 (3.6–4.4)	4.5 \pm 0.20 (4.4–4.7)

differ in ventral coloration. The syntypes of *P. boliviana* and the KU specimens from Chulumani and Caranavi, Bolivia, have flank tubercles tipped with dark brown spots; the venters are dark brown with areas of pale mottling (some have no pale areas). Also, the venter of the male syntype of *P. boliviana* is slightly paler than those of the KU specimens.

One of the specimens of the type-series of *P. pailona* has just a hint of such flank spots (CM 36278) and the others lack them. Moreover, two of these have a white lateral stripe on the anterior flanks, bordered below by a dark blue stripe. The venters of these frogs are almost immaculate, a diagnostic feature noted by Shreve (1959).

Most of the frogs from Jaciara, Brazil, have a hint of the dark tips on the flank tubercles, and all have a more discrete lateral stripe as well, bordered below by a dark blue-gray stripe or wider area. The venters of this series are pale gray, slightly darker than the type-series of *pailona*, but not as dark as the Chulumani series.

The frogs from Agua Blanca, Argentina, consist of two series: one recently collected by me and the other collected by Dr. Raymond Laurent. The specimens collected by me have dark brown venters with pale mottling, and a few discrete dark spots on the flank tubercles. The older specimens have immaculate venters with almost no hint of the flank tubercle spots. The KU specimens from Finca Jakulica and Angosto del Pescado, Argentina are colored similarly to the recent KU specimens from Agua Blanca.

It appears that the striking differences in ventral coloration between the type-specimens of both nominal species are due to some preservation difference and/or fading over time. Additionally, all of the recently collected KU specimens have dark blue dorsal surfaces, and those of the other specimens are pale blue.

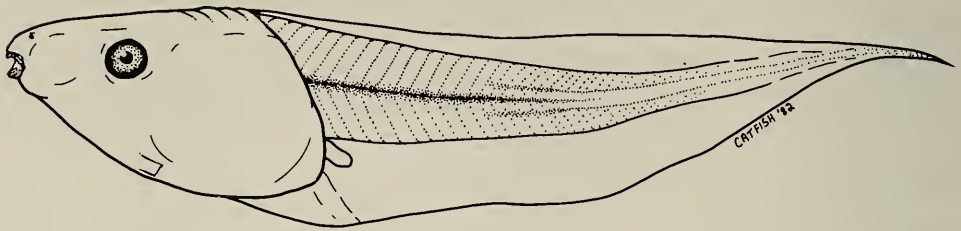


Fig. 3. Larva of *Phyllomedusa boliviana*, KU 183822.

In the preserved specimens there is also variation in the presence of a reticulated palpebrum, but this is clearly a preservation artifact. All of the specimens collected by me (KU 182969–90 and KU 183436–40) possessed a reticulated palpebrum in life. However, these specimens were stored for several months in formalin before transfer to ethanol, and the reticulation has been lost in all of them. All other specimens that I have examined still possess the reticulation.

Measurements of the specimens collected in northern Argentina are summarized in Table 1. Males from the vicinity of Chulumani, Bolivia range from 54.3 to 70.2 mm SVL ($n = 3$). The two males from Caranavi are 53.5 and 57.2 mm SVL. Those from El Pailón, Bolivia ($n = 4$) range from 56.1 to 64.7 mm SVL, and the males from Jaciara are 62.1–68.3 mm in SVL ($n = 6$).

Justification of synonymy.—Direct comparison of the type-specimens of *P. boliviana* and *P. pailona* leaves little doubt that the two names have been applied to the same species. Shreve based his comparison on material of “*boliviana*” that had been misidentified by Funkhouser (1957). As noted above, the immaculate venter of *P. pailona* is due to preservation artifacts. The iris color alone will diagnose *P. boliviana* from all other *Phyllomedusa*. Additionally, the combination of reticulated palpebrum, large parotoid glands, and absence of pattern on the posterior flanks and concealed surfaces of the hindlimbs will distinguish this species from all others of the genus.

Natural history.—At Aguas Blancas, Argentina, specimens were collected 0.5–1.0 m above ground in vegetation near ruts filled with water at the side of a highway. The males were calling; the call is a ‘tup-tup-tup,’ repeated every 2–10 seconds. At Angosto del Pescado and Finca Jakulica, individuals were collected around ponds or ditches filled with water, about 1 m above ground in vegetation; the males were calling in the same fashion. Barrio (1976) described the mating call of this species from the Rio Pescado, Argentina.

In Bolivia, individuals were calling from vegetation about 1 m above ground; none were collected near standing water, however. All specimens collected by me were taken at night. Laurent (1967) remarked on the natural history of the species in Argentina.

Tadpoles.—The lot of tadpoles was collected by day from a muddy roadside ditch, where KU 183439–40 were taken on the previous night. Tadpoles of *Ololygon rubra* were collected in the same ditch.

In general, the larvae of *P. boliviana* resemble those phyllomedusine larvae described by Cannatella (1980, 1982). The following description is based on KU 183822, which consists of seven tadpoles. A representative larva at Stage 32

(Gosner 1960) with a SVL of 15.0 mm and total length of 42.5 mm is illustrated in Fig. 3. Body slightly deeper than wide, deepest and widest at two-thirds the length of the body; top of head slightly convex; snout rounded in lateral profile; snout rounded in dorsal view; nostrils dorsolateral; internarial distance slightly greater than width of oral disc; eyes dorsolateral and directed laterally; spiracle a flap-like tube, ventral and sinistral to midline; spiracular opening at a point about midlength of the body; mouth anteroventral; cloacal tube short, dextral to base of caudal fin; caudal musculature slender, tapering gradually to posterior end of fin; myomeres weakly developed; at midlength of the tail the depth of the caudal musculature slightly less than depth of ventral fin, but greater than depth of dorsal fin; caudal musculature extending to tip of tail; dorsal fin shallow anteriorly, not extending onto body; dorsal fin deepest at two-thirds its length from anterior; ventral fin deepest at its midlength.

Mouth relatively small, with a shallow lateral fold; medial portion of upper lip lacking papillae; elsewhere, papillae present in one or two rows along borders; upper beak broadly curved and uniformly serrate; lower beak V-shaped and uniformly serrate; two upper and three lower rows of denticles; upper rows of same length; second upper row broadly interrupted medially; three lower rows of denticles uninterrupted; first two lower rows about same length; third row about one-half as long as upper two; denticles of third row smaller and fewer in number.

In life, dorsum transparent with gold and black pigments; lateral surfaces gold; venter transparent, with some gold pigment anteriorly; tail clear with fine distribution of melanophores; area above eye heavily pigmented with gold; iris white with black and gold flecks. In preservative, sides and top of head and body translucent, with scattered melanophores; intense concentration of melanophores covering gut, and obscuring view of intestines; caudal musculature flesh-colored; dorsal and ventral fins transparent, with fine distribution of melanophores in posterior one-half of dorsal and ventral fins, but not extending to tip of tail.

Eggs.—Three clutches of eggs were examined (IML 1349). One clutch is a lot of hatchling tadpoles. The second is a clutch of 154 tadpoles about to hatch from the egg membranes; the egg mass is still enveloped in a folded leaf. The third clutch is also encased in a folded leaf and consists of 142 eggs in the first stages of cleavage; the mean diameter of 20 eggs is 2.6 mm. A few of the eggs appear to be unfertilized and are smaller in size, and empty egg cases are found at the upper and lower ends of the cylindrical clutch in the same fashion as described for *P. hypocondrialis* by Pyburn (1980), and *P. duellmani* by Cannatella (1982).

Specimens examined.—ARGENTINA: *Jujuy*: Ruta Yuto-Ledesma, a 7 km de bifurcación, IML 1305(7), 1307(8); Bifurcación ruta Yuto, 1306(2), 1308; Pozo Colque (cerca de Yuto), 1309(3); Alrededores de Yuto, 1310; Yuto, UMMZ 127406; *Salta*: Río Pescado, IML 1345(24), 1397(8), 1349 (eggs); Aguaray, 1467(6); Abra Grande, Orán, 1682(2); Agua Blanca, 460 m, 1685 (11), 2145 (4), 2171, KU 182969–71, KU 128940–44, 128945 (skeleton); Angosto del Pescado 620 m, IML 2706(24), 1349(3) (three clutches eggs), KU 182972–75; Finca Jakulica, 560 m, 182976–90.

BRAZIL: *Mato Grosso*: Jaciara, UMMZ 127908, USNM 164097, MCZ 44942, AMNH 72450, KU 92322–25, 92326–27 (skeletons).

BOLIVIA: *La Paz*: 4.4 km E Chulumani, 1760 m, KU 183436; 2.1 km E Chulumani, 1900 m, 183437–38; Chulumani, 2000 m, BMNH 1947.2.22.33 (syntype); 15.7 km S Caranavi, 900 m, KU 183439–40, 183822 (larvae); *Santa Cruz*: Río

Grande, Cabezas, MACN 3483(5); El Pailón, 350 m, CM 36278–79 and MCZ 29679 (paratypes of *P. pailona*); MCZ 29677 (holotype of *P. pailona*).

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